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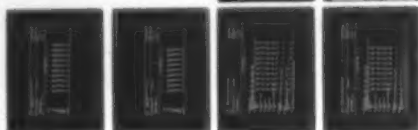
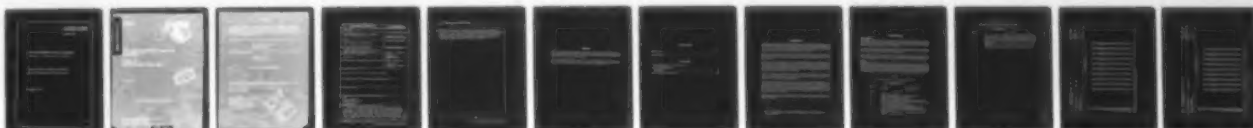
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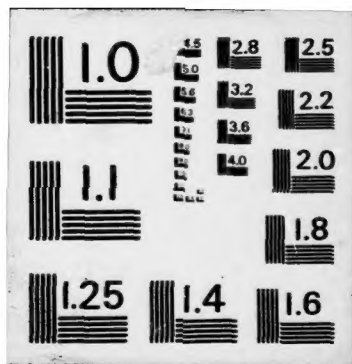
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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK
VOLUME 59. QU-22B IN-FLIGHT CREW NOISE

AEROSPACE MEDICAL RESEARCH LABORATORY,
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

NOVEMBER 1975

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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

Volume 59 QU-22B IN-FLIGHT CREW NOISE

NOVEMBER 1975



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AEROSPACE MEDICAL RESEARCH LABORATORY
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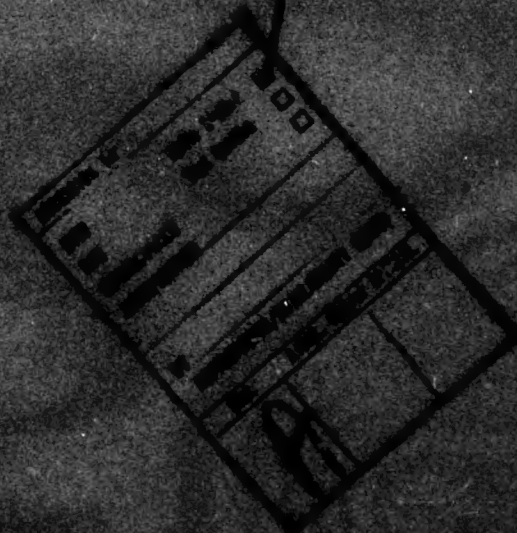
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FOR THE COMMANDER


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Director
Biodynamics and Biomechanics Division
Aerospace Medical Research Laboratory

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The QU-22B is a USAF light utility aircraft used for infiltration surveillance. This report provides measured data defining the bioacoustic environments at flight crew locations inside this aircraft during normal flight operations. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of		

personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

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PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 72310418, Measurement of Noise and Vibration Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci prepared this report.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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INTRODUCTION

The QU-22B is a USAF light utility aircraft used for infiltration surveillance. This aircraft, which is manufactured by the Beech Aircraft Corporation, is powered by one GTSIO-520-G reciprocating engine rated at 375 hp at 3,400 rpm maximum take-off power. The engine drives a Hartzell three-blade constant-speed, slow-turning, quiet, 2.29 m diameter propeller through a 0.6667 gear reduction. The engine is manufactured by the Teledyne Continental Motors Corporation.

This volume provides measured data defining the bioacoustic environments produced inside this aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the QU-22B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

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1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

IN-FLIGHT NOISE

MEASUREMENTS

All noise measurements were made on-board a standard-configured QU-22B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard QU-22B environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the QU-22B aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1
MEASUREMENT LOCATION AND TEST CONDITIONS

QU-22B, Eglin AFB, 29 Jul 1971
Serial # 69-7704

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Right Seat	Seated Head Level
CONDITION	DESCRIPTION	
A	Engine start, right door open.	
B	Taxiing — 20" Hg. Manifold Pressure, 1500-2000 RPM, doors closed.	
C	Engine check — 23" Hg. Manifold Pressure, 2100 RPM.	
D	Takeoff — 37" Hg. Manifold Pressure, 3400 RPM.	
E	Initial acceleration — gear and flaps up, 37" Hg. Manifold Pressure, 3400 RPM.	
F	Climb — 37" Hg. Manifold pressure, 3400 RPM, 100 KIAS, 800' / , 4-500'/min rate of climb.	
G	Same as F — 3500' / , 300'/min rate of climb.	
H	Climb — 35" Hg. Manifold Pressure, 3400 RPM, 8.0M PA /.	
I	Normal cruise — 32" Hg. Manifold Pressure, 2900 RPM, 130 KIAS, 9.5M PA.	
J	Orbit cruise — 29" Hg. Manifold Pressure, 2900 RPM, 130 KIAS, 9.5M PA.	
K	Gear down descent — 25" Hg. Manifold Pressure, 2500 RPM, 150 KIAS, 9.5M PA ~ , 2000'/min rate of descent.	
L	Clean descent — 29" Hg. Manifold Pressure, 2900 RPM, 200 KIAS, 4000'/min rate of descent.	
M	140 KIAS, 31" Hg. Manifold Pressure, 2900 RPM, 5.0M PA.	

TABLE 1 (Continued)

MEASUREMENT LOCATION AND TEST CONDITIONS

QU-22B, Eglin AFB, 29 Jul 1971

Serial # 69-7704

<i>POSITION</i>	<i>DESCRIPTION</i>
N	Dog Leg to GCA pattern — 31" Hg. Manifold Pressure, 3400 RPM, 140 KIAS, 4.0M PA.
P	GCA pattern, base turn — 26" Hg. Manifold Pressure, 3400 RPM, 2.3M PA, 130 KIAS.
Q	Glide path — 32" Hg. Manifold Pressure, 3400 RPM, 105 KIAS, gear down, flaps 20%.
R	GCA final approach — 27" Hg. Manifold Pressure, 3400 RPM, 110 KIAS, 1.3M PA, gear down, flaps 20%.
S	VFR overhead traffic pattern — 32" Hg. Manifold Pressure, 3400 RPM (bleed to 23" Hg. in nitchout).
T	VFR final approach — 15" Hg. Manifold Pressure, 2800 RPM, gear down, flaps 20%.

TABLE: MEASURED SOUND PRESSURE LEVEL (D9)										
2										
NOISE SOURCE/SUBJECT: (OPERATION:)										
QU-22B AIRCRAFT ()										
INFLIGHT NOISE LEVELS ()										
LOCATION/CONDITION										
FREQ (HZ)	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J
25	96	94	104	99	94	95	94	94	91	91
31.5	103	103	104	105	99	99	99	98	97	96
40	105	107	106	108	101	98	98	97	93	93
50	96	96	99	95	95	95	93	92	90	91
63	95	94	99	95	92	93	92	91	93	93
80	94	96	94	100	100	102	101	102	104	100
100	96	93	109	104	105	108	108	106	116	109
125	100	103	96	101	100	105	103	100	103	101
160	89	95	99	105	107	103	102	98	103	102
200	90	93	91	97	99	99	100	96	104	104
250	88	87	94	103	103	104	107	100	98	97
315	79	81	84	95	94	93	93	93	94	91
400	77	77	83	96	93	93	93	90	93	90
500	79	78	80	89	90	90	91	90	92	90
630	76	76	78	90	92	91	91	91	92	89
800	75	71	76	87	89	89	89	88	88	86
1000	73	70	75	81	83	85	84	84	85	84
1250	71	68	73	79	81	83	81	81	82	81
1600	69	66	70	78	79	83	79	80	81	79
2000	69	67	72	79	80	83	81	81	83	82
2500	66	65	68	76	77	79	78	78	82	79
3150	64	63	66	74	75	79	77	77	81	79
4000	63	63	66	74	75	78	77	77	83	80
5000	61	62	64	73	74	75	75	76	80	77
6300	60	60	62	70	72	73	73	74	79	76
8000	60	60	62	71	71	73	73	73	80	77
10000	59	60	61	69	69	70	70	72	78	75
12500	59	59	60	69	68	69	70	72	78	74
16000	61	61	62	69	69	70	71	73	78	75
OVERALL	109	110	113	113	112	113	113	110	117	112

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
2 1/3 OCTAVE BAND											
NOISE SOURCE/SUBJECT: (OPERATION:)											
QU-22B AIRCRAFT ()											
INFLIGHT NOISE LEVELS ()											
IDENTIFICATION:)											
OMEGA 3.2											
TEST 71-014-056											
RUN 02											
10 JAN 75											
PAGE F2											
LOCATION/CONDITION											
FREQ (HZ)	1/K	1/L	1/M	1/N	1/P	1/Q	1/R	1/S	1/T		
25	94	93	92	93	92	91	90	93	92		
31.5	100	100	98	98	98	99	97	98	97		
40	98	94	94	98	100	98	97	100	98		
50	94	94	92	91	92	95	95	93	96		
63	97	94	91	90	91	94	95	92	94		
80	114	100	99	100	100	97	101	100	97		
100	107	111	107	106	105	103	103	107	101		
125	102	103	100	102	101	99	98	102	98		
160	104	101	102	99	104	100	102	102	96		
200	102	103	105	98	97	95	97	99	105		
250	93	98	98	99	105	102	103	106	98		
315	94	97	92	92	93	91	92	93	91		
400	92	97	92	92	92	91	90	92	86		
500	91	98	91	92	90	89	89	51	84		
630	90	96	90	90	89	90	88	90	85		
800	88	94	88	87	86	86	85	87	83		
1000	86	92	85	84	83	82	81	84	79		
1250	84	90	83	82	81	80	79	81	76		
1600	82	89	82	81	79	78	78	79	75		
2000	84	89	84	83	82	80	80	82	78		
2500	84	89	82	81	79	77	78	80	76		
3150	83	90	82	79	78	77	77	78	75		
4000	84	91	84	81	80	77	78	80	76		
5000	81	88	80	79	77	75	75	77	73		
6300	81	89	79	77	75	73	73	75	72		
8000	81	90	80	78	75	72	74	74	72		
10000	79	88	78	76	75	71	72	73	69		
12500	79	88	78	77	75	70	72	72	69		
16000	79	87	77	76	75	70	72	72	69		
OVERALL	116	114	111	110	111	109	110	112	109		

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE 1 MEASURED SOUND PRESSURE LEVEL (DB)		IDENTIFICATION									
2											
NOISE SOURCE/SUBJECT		OPERATION									
QU-228 AIRCRAFT											
INFLIGHT NOISE LEVELS											
		LOCATION/CONDITION									
		1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J
FREQ (HZ)											
31.5	107	108	109	110	103	102	102	102	102	99	99
63	100	100	103	102	101	103	102	102	102	105	101
125	102	104	110	108	110	110	110	110	107	117	110
250	92	94	96	104	105	105	108	102	102	105	105
500	82	82	85	98	97	96	96	95	95	97	94
1000	78	75	79	89	91	91	91	90	90	90	88
2000	73	71	75	82	84	87	84	84	84	87	85
4000	68	67	70	78	79	82	81	81	81	86	84
8000	64	64	66	75	75	77	77	77	78	84	81
16000	63	63	64	72	72	72	73	73	75	81	77
OVERALL	109	110	113	113	112	113	113	113	110	117	112

TABLE 1 MEASURED SOUND PRESSURE LEVEL (DB)											
2											
NOISE SOURCE/SUBJECT: (OPERATION:)											
QU-22B AIRCRAFT ()											
INFLIGHT NOISE LEVELS ()											
IDENTIFICATION:)											
OMEGA 3.2											
TEST 71-014-056											
RUN 02											
10 JAN 75											
PAGE J2											
LOCATION/CONDITION											
1/K 1/L 1/M 1/N 1/P 1/Q 1/R 1/S 1/T											
FREQ (HZ)											
31.5	103	101	100	101	103	102	101	102	101	101	101
63	114	102	100	101	101	100	102	101	101	100	100
125	109	112	108	108	108	106	106	109	109	103	103
250	103	105	106	102	106	103	104	107	107	106	106
500	96	102	96	96	95	94	94	96	96	90	90
1000	91	97	91	89	88	88	87	89	89	85	85
2000	88	94	87	86	85	83	83	85	85	81	81
4000	88	94	87	84	83	81	82	83	83	80	80
8000	85	94	84	82	80	77	78	79	79	76	76
16000	82	90	81	79	78	73	75	75	75	72	72
OVERALL	116	114	111	110	111	109	110	112	112	109	109

